Trust and consumption of public health information in the dynamics of COVID-19 vaccination hesitancy

Ruben Juarez[a,*], Zheng Kang[a], May Okihiro[b], Krit Phankitnirundorn[c], Alika Maunakea[c]

[a] Department of Economics and UHERO, University of Hawaii, Honolulu, HI 96822, USA.
[b] Department of Pediatrics, John A. Burns School of Medicine, University of Hawaii, Honolulu, HI 96813, USA.
[c] Department of Anatomy, Biochemistry and Physiology, John A. Burns School of Medicine, University of Hawaii, Honolulu, HI 96813, USA
[*] Corresponding Author: Ruben Juarez (rubenj@hawaii.edu)

Correspondence

Ruben Juarez; 2424 Maile Way, Honolulu, Hawaii 96822, USA

Email: rubenj@hawaii.edu

Phone: 808-233-9524

Word Count of Manuscript Text

2935 words

Keywords: COVID-19 | Vaccine Hesitancy | Information Trust | Information Consumption

Running title: Juarez *et al*.: Trust and consumption of public health information in the dynamics of COVID-19 vaccination hesitancy

Key Points

Question: How does education, trust, and consumption of COVID-19 information affect vaccination uptake?

Findings: (1) Early adopters of the vaccine exhibited a higher degree of trust in and consumption of official sources of COVID-19 information relative to late and non-adopters. (2) Late adopters exhibited a lower degree of trust in and consumption of COVID-19 related information from unofficial sources in comparison to non-adopters. (3) The level of education is only a significant factor in vaccine uptake within the first two months of being eligible.

Meaning: Results offer novel insights into how education, trust, and consumption of COVID-19 information change over time to influence vaccine uptake.

Structured Abstract

Importance: Vaccine hesitancy remains a significant barrier to achieving herd immunity and preventing the further spread of COVID-19. Understanding contributors to vaccine hesitancy and how they change over time may improve COVID-19 mitigation strategies and public health policy.

Objective: To investigate the effect of education, trust, and consumption of COVID-19 information on influencing vaccine uptake over time.

Design: The NIH RADx-UP survey that includes demographics, vaccination status, use, reliance, and trust on sources of COVID-19 information was administered from September to November 2021.

Setting: Adult residents of Hawai‘i completed an online survey via Qualtrics.

Participants: A total of 1,594 adults participated in our survey. 37.5% self-identified as Native Hawaiian, 37.8% Asian, 15.9% Caucasian, 3.5% Pacific Islander, and 5.3% Other. 70% were women; 43.2% were younger than 40, 45.9% were between 50-59, and 10.9% at 60 years or older.

Main outcome or measures: COVID-19 vaccine uptake, degree of trust in sources of COVID-19 information, frequency of consumption of COVID-19 information from such sources, and sociodemographic factors were measured during the initial phase of vaccine rollout.

Results: Participants represented all major racial/ethnic groups in Hawai‘i. Probit regression analysis revealed that individuals who were fully vaccinated within two months of being eligible (early adopters) tended to have a higher level of education and exhibited a higher degree of trust in and consumption of official sources of COVID-19 information compared to those who waited 3-6 months (late adopters) or those who remained unvaccinated after six months of being eligible (non-adopters). There was no difference in the level of education between late adopters and non-adopters. Instead, late adopters had higher levels of trust in and consumption of COVID-19 related information from official sources relative to non-adopters while exhibiting lower levels of trust in and consumption of COVID-19 related information from unofficial sources.

Conclusion and Relevance: This study shows how education, the degree of trust in sources of COVID-19 information, and frequency of consumption of COVID-19 information interact and change to influence vaccine uptake and offer novel insight into hesitancy over the course of the COVID-19 vaccine rollout relevant to public health policy.

Introduction

COVID-19 vaccination is the strongest tool available to date in preventing the spread of and reducing mortality due to COVID-19 [1] [2]. The United States is one of several vaccine-producing countries where the domestic supply has far exceeded the demand since June 2021 [3]. Vaccine hesitancy (including vaccine refusal) continues to undermine COVID-19 mitigation strategies [1] [4], limiting herd immunity and perpetuating viral spread. To overcome this barrier, significant efforts have been made at all levels of government to promote vaccine uptake. Multiple states are providing vaccine incentives, with mixed results of effectiveness [5] [6]. In addition, vaccine mandates have taken effect, focusing initially on essential workers and high-risk businesses, which have shown to be effective to increase vaccine uptake [7]. However, few studies have been able to capture the nuanced changes to attitudes and perceptions of the COVID-19 vaccine during the course of the vaccine rollout.

To inform such policies, understanding the dynamics of vaccine hesitancy is crucial. Although prior studies of populations outside Hawaii demonstrated that vaccine hesitancy associates with distrust and misinformation [8] [9], none have yet reported whether these factors account for the under-vaccination rates. Meanwhile, recent studies have examined the social and behavioral characteristics of unvaccinated individuals. Socioeconomic factors including education and income impact willingness of vaccination, and a recent survey indicated that race, religious beliefs and political preferences also contribute to vaccine hesitancy [10]. One study suggested that people refuse to get vaccinated due to fake news and advertisements on social media [11] or due to political preferences [1]. Although trust in and consumption of information relevant to the COVID-19 vaccine appear to be important, how they interact to influence an individual's decision about vaccination is not fully understood.

To gain insight into these dynamic interactions, we collected standardized data from a representative survey of adults in the state of Hawaii during the vaccine roll-out from September to November 2021 as part of the National Institutes of Health (NIH) Rapid Acceleration of Diagnostics in Underserved Populations (RADx-UP) initiative. Herein, we show for the first time the dynamics of vaccine hesitancy over the time that individuals became eligible for vaccination, identifying key factors that include trust and consumption of COVID-19 relevant information. Despite our focus on Hawaii's population, these results confirm social factors previously implicated in vaccine hesitancy and offer novel insight into how these factors interact to influence vaccine uptake that will be useful for public health policy in the US.

Data

Taking advantage of the infrastructure developed in partnership with the NIH RADx-UP initiative at the University of Hawaii and five federally qualified health centers in the state of Hawaii, we collected data from a representative survey of 1,594 adults in the state of Hawaii during the vaccine rollout from September to November, 2021.

This comprehensive survey included over 100 questions related to demographics, vaccination status and attitudes towards vaccination. For this analysis, we considered the time that

individuals received the vaccine as a dependent variable, and the participants of the survey were stratified into three groups based on the time (in months) they initiated the first dose of any of the three FDA approved COVID-19 vaccines (e.g. Pfizer-BioNTech, Moderna and Johnson & Johnson's Janssen) after they were eligible: (1) *early adopters*, those that were vaccinated within two months of eligibility; (2) *late adopters*, those who waited to get vaccinated in months 3-6 of being eligible; and (3) *non-adopters*, those who refused to get vaccinated after six or more months after eligibility, or who were only vaccinated due to a mandate by their employers or the government. Note that although our definition of adopter is based on vaccine initiation, the results below remain largely unchanged if we restrict to individuals who completed vaccination.

In addition, we examined five independent variables that include education level, official trust index, unofficial trust index, official information consumption index, and unofficial consumption index. All independent variables were quantified from the Likert scales and normalized between 0 and 1. The official and unofficial trust and consumption indexes were computed as the average of trust and consumption within a subset of official and unofficial sources. Official sources included government, healthcare providers, and traditional channels of communication such as TV, radio, and print news; unofficial sources included social media channels, friends, family, acquaintances, and faith leaders. See Definition in the Supplemental Information for the precise definition of these variables. Table 1 lists a summary of all variables used and Figure 1 shows a summary chart for key variables.

The count of months at which individuals initiated their first doses after being eligible was represented by the variable *vaccination month*. We set *vaccination month* equal to the maximum value, 6, if the participant never initiated the vaccination. In Figure 2, for example, the trust in official information (rounded up to the nearest percentiles) is shown along with *vaccination month*. At the time stamp that *vaccination month* equals to zero, all participants (100% or 1.0 in the graph) are represented in the table, while individuals drop off the graph as *vaccination month* increases, since some individuals initiate vaccination on that month. The graph clearly shows that almost all of those with the highest trust in official information sources (Quantiles 75% and 100%) initiated their vaccination in the first month of their eligibility. However, most of those with the lowest trust in official information sources (Quantile 25%) did not initiate their vaccination in the first two months of being eligible, and there were still over 30% of them who did not initiate their vaccination after six months past their eligibility.

Methods

To identify factors underlying vaccine hesitancy, our regression models were separated into two parts: the break-down Probit regression analysis for the comparison of individuals based on *early*, *late* or *non-adopters*, and the overall survival analysis (Cox regressions) for the complete data set as a robustness check.

Probit regressions were used to estimate the probability that individuals are *early adopters*, *late adopters* or *non-adopters*. These Probit regression models include two groups compared in

each regression. We performed two sets of comparisons: (1) *early adopters* versus everyone else, and (2) *late adopters* versus *non-adopters*. The respective identification models are as follows:

$$early_{ic} = \alpha + \beta \times Trust_{ic} + X_{ic} + u_{ic} \quad (2)$$

and

$$late_{ic} = \alpha + \beta \times Trust_{ic} + X_{ic} + u_{ic} \quad (3)$$

where the variable $early_{ic}$ equals to 1 if the participant i is an *early adopter* and 0 otherwise; the variable $late_{ic}$ equals to 1 if the participant i is a *late adopter* and 0 if *non-adopter*. Meanwhile, X_{ic} is a control variable that includes individual-level race, gender, age, education and the CDC social vulnerabilities of the community where the individual lives[1]. The trust variable index, $Trust_{ic}$, is substituted by the consumption variable, $Consume_{ic}$ when estimating the information consumption indexes. The residual term is represented by u_{ic}.

Independently, we performed a survival analysis based on Breslow method for ties [12] using the variable *vaccination month* to validate the efficiency of our Probit models as a robust check. Under this method, all participants are not vaccinated at time 0, and as they become eligible to be vaccinated, a proportion of participants drop off (get their first dose of the vaccine) at each time. The model observes the proportion of participants dropping off at each time stamp to identify the factors that influences vaccination since they were eligible. Formally, the regression model is shown below:

$$Vaccmonth_{ic} = \alpha + \beta \times Trust_{ic} + X_{ic} + u_{ic} \quad (1)$$

where other variables and assumptions are consistent with the above.

Results

Contributors to early adoption of COVID-19 vaccine: education, consumption and trust in official information

The Probit regression results (see Table 2) based on equation 2 compared *early adopters* to all others. This analysis suggested a positively significant impact of education level [1.78, p<0.001; 95% CI = (1.39, 2.17)], which indicated that individuals with a higher level of education were more likely to get vaccinated as soon as they were eligible. Indeed, this is equivalent to an increase probability of 60% from being an *early adopter* if an individual has an advance degree rather than ending education at 6-8 grade, or equivalently, an average of 10% increase probability of being an early adopter for each year of school past 8th grade.

Note the significant impacts of the trust [1.87, p<0.001; 95% CI = (1.54, 2.20)] in and consumption [1.67, p<0.001; 95% CI = (1.27, 2.08)] of official information sources on the vaccination uptake decisions made in the early stage. Interestingly, the early adoption of vaccination does not show a significant correlation with trust in and consumption of unofficial information sources [-0.11, p=0.50; 95% CI = (-0.44, 0.22) and -0.04, p=0.81; 95% CI = (-0.37, 0.29), respectively for trust in and consumption of unofficial information sources], which indicated

[1] See details on https://www.atsdr.cdc.gov/placeandhealth/svi/index.html.

that the early adoption decision is not impacted by unofficial information sources. We note that the coefficient for official trust equal to an increase probability of being an *early adopter* by 61% if the individual increased his level of official trust in official sources from "Not at all" to "A great deal". Similarly, we note the coefficient for official consumption equals to an increase probability of being an *early adopter* of 48% from an individual who "Never" consumes official information sources to one who "Always" consumes official information sources.

Contributors to late adoption of COVID-19 vaccine: consumption and trust in official and unofficial information

The key results based on equation 3 is also shown in Table 2. Strong positive of the trust in and consumption of official information sources on the probability of initiating vaccination within months 3-6 are shown impacts [1.14, $p<0.001$; 95% CI = (0.63, 1.65) and $p<0.001$; 1.18, 95% CI = (0.55, 1.81), respectively for trust in and consumption of official information sources]. The results suggested that the main contributors of vaccination refusal (or continuing hesitancy after 6 months after being eligible) are trust in and consumption of official information sources, which indicated that individuals get vaccinated after hesitation due to trust and consumption in government and other official information sources. Moreover, in our robustness checks, the education level by itself is insignificant [-0.63, $p=0.06$; 95% CI = (-1.29, 0.27)]. We note that the coefficient for official trust equal to an increase probability of being a *late adopter* by 38% if the individual increased his level of trust in official sources from "Not at all" to "A great deal". Similarly, we note the coefficient for official consumption equals to an increase probability of being a *late adopter* of 42% from an individual who "Never" consumes official information sources to one who "Always" consumes official information sources.

Meanwhile, we observed that the significant impact of the trust in unofficial information sources on the final decision to get vaccinated indicates a negative impact of unofficial information sources in vaccine uptake [-0.71, $p=0.014$; 95% CI = (-1.28, -0.14)]. These results suggest that those non-adopters choose not to be vaccinated or continue hesitating after 6 months past their eligibility because of their higher trust in unofficial sources of COVID-19 information. We note that the coefficient for unofficial trust equal to a decrease probability of being a *late adopter* by 25% if the individual increased his level of trust in unofficial sources from "Not at all" to "A great deal".

The overall survival analysis

To further validate the Probit regression analysis and illustrate these results, we show the results from the overall survival analysis on the vaccination decisions and behaviors (See Table 2). Based on the results from the Cox regressions under Breslow methods, the education level and trust in and consumption of official information sources are proved to have positive effects on the initiation of vaccinations [1.630, $p<0.001$; 95% CI = (1.42, 1.87) and 2.106, $p<0.001$; 95% CI = (1.86, 2.38) and 1.911, $p<0.001$; 95% CI = (1.67, 2.18), respectively for education, trust in and consumption of official information source], while the trust in and consumption of unofficial

information sources do not have significant effects on the initiation of vaccinations, consistent with the results of the Probit results above. We note that the coefficients here represent the percentage change of the vaccination behaviors regarding each one-point estimate of the independent variables, which indicates negative correlations on values below one.

Discussion

Vaccine-mediated herd immunity is one of the most effective public health strategies to mitigate the adverse outcomes of COVID-19. However, vaccine hesitancy remains a considerable barrier to this strategy. Therefore, identifying the factors that contribute to vaccine hesitancy and how these may change over the time it takes to reach herd immunity has significant public health implications. Our findings provide an avenue to design dynamic public health policies that include education, consumption, and trust in COVID-19 information, but the content of these policies is time-dependent. Herein, we identify how factors that contribute to vaccine hesitancy interact and influence decisions regarding vaccine uptake over the course of the COVID-19 vaccine rollout.

In the first two months since individuals become eligible to be vaccinated, the level of education makes a difference to an individual's choice. However, it is not a significant factor for individuals that wait to become vaccinated 3 or more months after they become eligible. Instead, for these individuals, their decision to either remain unvaccinated or become vaccinated during this time is significantly driven by trust in and consumption of COVID-19 information. Indeed, trust in and consumption of official sources of COVID-19 information appears to increase the probability of vaccination for individuals who have not been vaccinated after 3 months since they became eligible. On the other hand, trust in and consumption of unofficial sources of COVID-19 information decreases the probability of vaccination for these individuals. Similar results have been obtained on the trust in official information sources impacting vaccination hesitancy and refusal before the development of the vaccines [13], which discussed the psychological differences among those accepting, hesitating, and refusing future vaccinations. Notably, some of these findings in early stages of the pandemic were observed in our data post vaccine uptake.

The negative relationship between trust in unofficial sources and vaccine uptake might indicate that such sources are actively discouraging vaccination, to potentially include factors such as the spread of misinformation that has previously been implicated in contributing to reduced vaccine uptake [9] [14] [11]. Our results suggest that to increase the vaccination of non-adopters, governments and official forces should complement their campaigns with unofficial information sources, including community and faith leaders and social media influencers, especially to decrease the number of non-adopters.

We expect that our findings would be relevant to COVID-19 boosters as well. As Omicron-driven surges threatens the US, this would be particularly important to understand. Indeed, our data suggests that COVID-19 mitigation policies should incorporate interventions that fosters trust in official sources of COVID-19 information and promotes health literacy at early and late stages of the booster shots rollout.

We note that while our survey is representative of the population in the state of Hawaii, it may not necessarily represent the views in other states. Indeed, our survey collects statewide information from Hawaii, a multicultural state rich with predominately Asian, White, Native Hawaiian and Pacific Islander races, yet it lacks significant representation from other races, including Blacks, Hispanics and Native Americans which are not predominant in Hawaii. In order to minimize this limitation, we note that our robustness check shows that race is not a significant contributor in either of our results. Another limitation of this study is that our model does not account for other factors such as income, household size, job type/sector, risk of COVID-19 exposures, pre-existing medical conditions, and political preference, that may influence vaccine uptake. In order to minimize this limitation, we controlled for other demographic variables that include race, gender, age, education, as well as the Social Vulnerability Index (SVI) of where individuals live, which uses census data to identify and map places where a community may have more difficulty preventing human suffering and financial loss in a disaster. Notably, the SVI has been found to be negatively associated with vaccine uptake in a large nationwide study [15]. Concordant with this study, we found that SVI is negatively associated with vaccine uptake in our data from Hawaii. However, once accounting for education, consumption and trust in COVID-19 information, we found that the SVI is no longer associated with vaccine uptake.

In conclusion, vaccines have the potential to decrease the adverse effects of COVID-19 with significant externalities for all. However, these benefits are only possible in a population where the vaccine is widely used to reach herd immunity. Results of our study offer insight into the nuances of vaccine hesitancy with which relevant interventions that change over time may be tailored to increased vaccine uptake for all.

Acknowledgments

We thank the more than two dozen staff and volunteers at the Pacific Alliance Against COVID-19 who made this study possible. This project is funded in by grant numbers U54MD007601-34S2 from the National Institute on Minority Health and Health Disparities (NIMHD), and OT2HD108105-01 from the National Institute of Child Health and Human Development (NICHD), components of the National Institutes of Health (NIH), and its contents are solely the responsibility of the authors and do not represent the official view of NIMHD, NICHD or NIH. All authors have no conflicts of interest.

Data and materials availability

All data used for this article will be available de-identified as approved by the Waianae Coast Comprehensive Health Center Institutional Review Board.

Bibliography

[1] J. A. Frankel and R. Kotti, "The Virus, Vaccination, and Voting," National Bureau of Economic Research, 2021.

[2] N. E. Dean, J. W. Hogan and M. E. Schnitzer, *Covid-19 vaccine effectiveness and the test-negative design,* Mass Medical Soc, 2021.

[3] D. Engber, *Vaccination in America Might Have Only One Tragic Path Forward,* The Atlantic, 2021.

[4] J. S. Gans, "Vaccine Hesitancy, Passports and the Demand for Vaccination," National Bureau of Economic Research, 2021.

[5] T. Chang, M. Jacobson, M. Shah, R. Pramanik and S. B. Shah, "Financial Incentives and Other Nudges Do Not Increase COVID-19 Vaccinations among the Vaccine Hesitant," National Bureau of Economic Research, 2021.

[6] P. Campos-Mercade, A. N. Meier, F. H. Schneider, S. Meier, D. Pope and E. Wengström, "Monetary incentives increase COVID-19 vaccinations," *Science,* p. eabm0475, 2021.

[7] R. Juarez, A. Maunakea, M. Okihiro and C. Bonham, "The Efficacy of Hawaii COVID-19 Business Mandates," The Economic Research Organization at the University of Hawaii, 2021.

[8] C. A. Latkin, L. Dayton, G. Yi, A. Konstantopoulos and B. Boodram, "Trust in a COVID-19 vaccine in the US: A social-ecological perspective," *Social science & medicine (1982),* vol. 270, p. 113684, 2021.

[9] S. Loomba, A. de Figueiredo, S. J. Piatek, K. de Graaf and H. J. Larson, "Measuring the impact of COVID-19 vaccine misinformation on vaccination intent in the UK and USA," *Nature human behaviour,* vol. 5, no. 3, pp. 337--348, 2021.

[10] J. Khubchandani, S. Sharma, J. H. Price, M. J. Wiblishauser, M. Sharma and F. J. Webb, "COVID-19 vaccination hesitancy in the United States: a rapid national assessment," *Journal of Community Health,* vol. 46, no. 2, pp. 270--277, 2021.

[11] L. Chiou and C. Tucker, "Fake news and advertising on social media: A study of the anti-vaccination movement," National Bureau of Economic Research, 2018.

[12] N. Breslow, "Covariance analysis of censored survival data," *Biometrics,* pp. 89--99, 1974.

[13] J. Murphy, F. Valliéres, R. P. Bentall, M. Shevlin, O. McBride, T. K. Hartman, R. McKay, K. Bennett, L. Mason, J. Gibson-Miller and others, "Psychological characteristics associated with COVID-19 vaccine hesitancy and resistance in Ireland and the United Kingdom," *Nature communications,* vol. 12, no. 1, pp. 1--15, 2021.

[14] J. Roozenbeek, C. R. Schneider, S. Dryhurst, J. Kerr, A. L. Freeman, G. Recchia, A. M. Van Der Bles and S. Van Der Linden, "Susceptibility to misinformation about COVID-19 around the world," *Royal Society open science,* vol. 7, no. 10, p. 201199, 2020.

[15] M. M. Hughes, A. Wang, M. K. Grossman, E. Pun, A. Whiteman, L. Deng, E. Hallisey, J. D. Sharpe, E. N. Ussery, S. Stokley and others, "County-level COVID-19 vaccination coverage

and social vulnerability—United States, December 14, 2020--March 1, 2021," *Morbidity and Mortality Weekly Report,* vol. 70, no. 12, p. 431, 2021.

Table 1. Summary statistics on the survey data, including descriptive statistics showing the count and percentage of participantin each vaccination stages, related to general scales such as gender, race, age and education. The summary statistics of the overall trust variables are also shown with mean values and standard deviations for participants in each vaccination stage.

Characteristics	**Early-adopter** $N = 1150$[1]	**Late-adopter** $N = 145$[1]	**Non-adopter** $N = 299$[1]
[2]**Gender****			
Female	810 (70%)	103 (71%)	202 (68%)
Male	330 (29%)	42 (29%)	87 (29%)
[2]**Race*****			
Caucasian	181 (16%)	17 (12%)	55 (19%)
Native Hawaiian	381 (33%)	73 (50%)	144 (48%)
Pacific Islander	33 (3%)	5 (3%)	18 (6%)
Asian	504 (44%)	40 (28%)	58 (19%)
Other	50 (4%)	10 (7%)	24 (8%)
Unknown	1 (0%)	0 (0%)	0 (0%)
[2]**Education*****			
Less than High School	7 (1%)	7 (5%)	11 (4%)
High School Degree	125 (11%)	43 (30%)	78 (26%)
Technical Degree	355 (31%)	61 (42%)	107 (36%)
Bachelor's Degree	346 (30%)	24 (17%)	65 (22%)
Graduate Degree	305 (27%)	7 (5%)	25 (8%)
[2]**Age*****			
18 to 39	418 (36%)	76 (52%)	195 (65%)
40 to 59	574 (50%)	61 (42%)	96 (32%)
60 or Older	158 (14%)	8 (6%)	8 (3%)
Trust and Consumption			
[3]Official Trust***	0.76 (0.20)	0.63 (0.26)	0.52 (0.26)
[3]Official Consumption***	0.54 (0.18)	0.47 (0.20)	0.38 (0.20)
[3]Unofficial Trust	0.54 (0.22)	0.51 (0.23)	0.56 (0.21)
[3]Unofficial Consumption*	0.33 (0.22)	0.33 (0.21)	0.36 (0.22)

1: Numerical values in the cells: n (%); Mean (SD).

2: Pearson's Chi-squared test.

3: Kruskal-Wallis rank sum test.

Statistical significance at * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$ are shown.

Table 2. Regression results outlying the impact of education, trust and consumption variables on vaccination uptake. Part (a) describes the comparison between early adopters and all others; Part (b) describes the comparison between late adopters and non-adopters; and Part (c) describes the overall survival analysis based on Cox regression.

Independent Variables	Early[1]	Probability[2]	Late[3]	Probability[4]	Overall[5]
Official Trust	1.87*** (0.17)	61%	1.14*** (0.26)	38%	2.106*** (0.13)
Unofficial Trust	-0.11 (0.17)		-0.71** (0.29)	-25%	0.91 (0.05)
Official Consumption	1.67*** (0.21)	48%	1.18*** (0.32)	42%	1.911*** (0.13)
Unofficial Consumption	-0.04 (0.17)		-0.44 (0.30)		0.95 (0.06)
Education	1.78*** (0.20)	60%	-0.63* (0.34)		1.630*** (0.11)
Control Variables					
Gender - Male	-0.01 (0.09)		0.01 (0.14)		1.00 (0.03)
Age	0.03*** (0.003)		0.02*** (0.006)		1.01*** (0.001)
Social Vulnerability	8.08e-6* (4.40e-6)		4.39e-6 (7.91e-6)		1.00 (1.38e-6)
Race (Comparison based on Caucasian)					
Asian	0.43*** (0.12)		0.38* (0.22)		1.14*** (0.04)
Native Hawaiian	0.06 (0.11)		0.24 (0.20)		1.05 (0.04)
Other and Pacific Islander	-0.17 (0.14)		0.06 (0.25)		0.95 (0.05)

1: Probit analysis on the comparison between early adopters and all others.
2: The marginal probability change on each 1-point estimate elevation in the independent variables, based on the comparison between early adopters and all others.
3: Probit analysis on the comparison between late adopters and non-adopters.
4: The marginal probability change on each 1-point estimate elevation in the independent variables, based on the comparison between late adopters and non-adopters.
5: Overall survival analysis on the time stamp of participants getting vaccinated, based on cox regression with Breslow method for ties, for robustness check.
(Standard errors in parentheses)
(Significance level: * p<0.10, ** p<0.05, *** p<0.01)
(Probability shown only for significant independent variables)

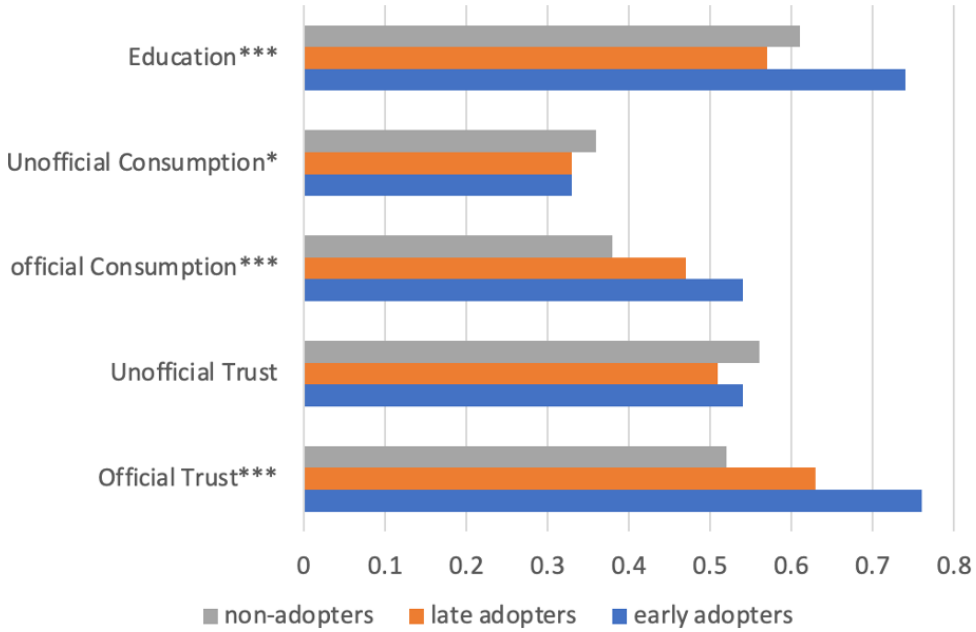

*Figure 1. Summary graph depicting the mean value on each essential variable, including education, consumption, and trust in official and unofficial information sources. Kruskal-Wallis rank sum tests with statistical significance at * $p < 0.10$ and *** $p < 0.01$ are shown.*

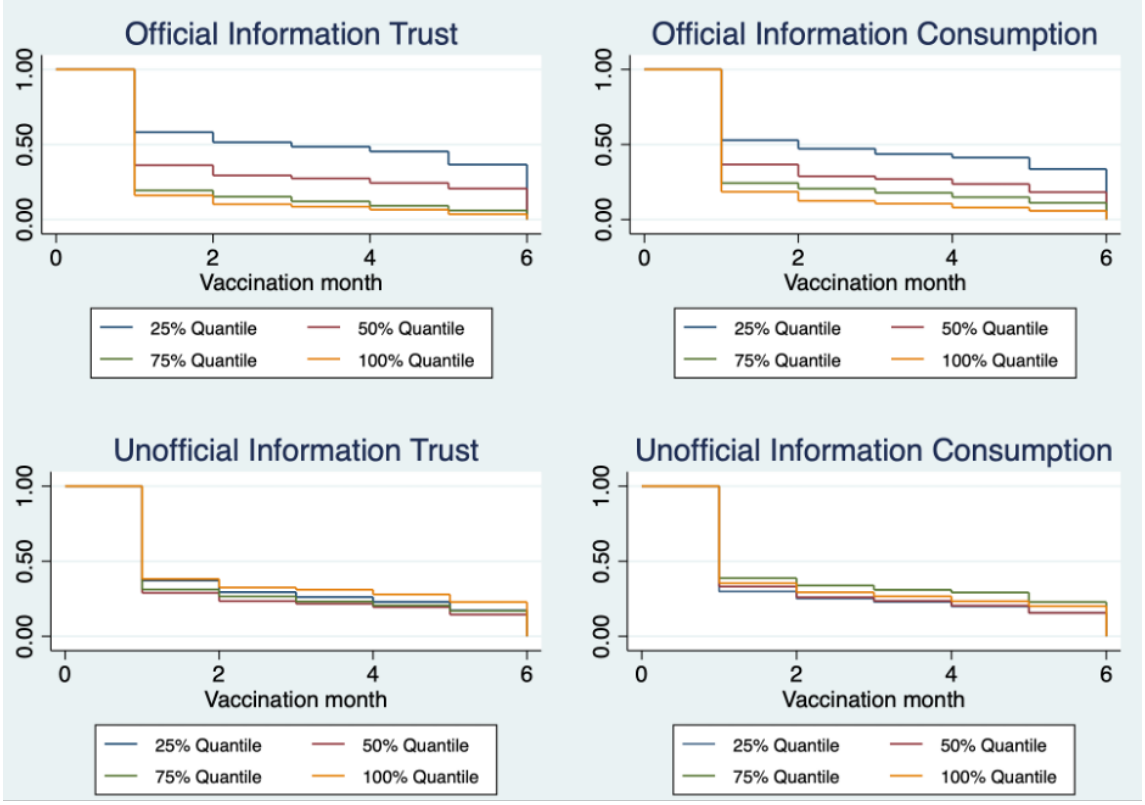

Figure 2. Kaplan-Meier survival of trust and consumption in official/unofficial information sources (rounded up to the nearest percentile) related to vaccination month since becoming eligible. As the graph shows, people with more trust in official information sources are morelikely to get vaccinated and get it earlier.